65 Breeding Critters—More Traits

INVESTIGATION

When you considered Skye and Poppy's breeding, you focused on their tail colors. The tail-color inheritance followed the same pattern described by Mendel in his pea plant inheritance experiments. One gene, for which there are two alleles, determines each characteristic. Each characteristic has two versions, or traits. For the characteristic of tail color, the traits are blue and orange, and the alleles of the tail-color gene are referred to as **T** and **t**. One trait is completely dominant over the other, recessive, trait. In this case, blue tail color (**T**) is dominant over orange (**t**).

In fact, Skye and Poppy have a variety of traits. Some of them follow the pattern of inheritance that was described by Mendel. Others are inherited in a slightly different pattern. In this activity, you will look at some other traits and investigate how they are inherited.

Skye

Poppy

Lucy

Ocean

CHALLENGE

What are some patterns of inheritance other than the one discovered by Mendel?

MATERIALS

For each group of four students

colored pencils

1 plastic cup

For each pair of students

1 Student Sheet 65.1, "Critter Breeding Worksheet"

2 pennies

THE MODEL

The table below shows Skye's and Poppy's traits. It also shows the traits of all their offspring. In this activity, you will look at more traits in the Generation Three offspring, which are produced when Generation Two offspring mate with each other. Lucy, a female, and Ocean, a male, are the Generation Two critters who will mate.

Table 1: Generation One and Generation Two Traits

Characteristic	Skye	Poppy	100 Offspring (such as Lucy and Ocean)
Body segments (number)	2	3	3
Leg color	blue	red	blue
Eyes (number)	2	3	2
Nose length	short	long	medium
Tail color	blue	orange	blue
Tail style	straight	curly	48 curly, 52 straight
Antennas (number)	1	2	2
Spikes (color and number)	1 short blue	2 long green	1 short blue + 2 long green
Sex	male	female	53 female, 47 male

PROCEDURE

1. Work in pairs. Place Student Sheet 65.1, "Critter Breeding Worksheet," between you and your partner. The person sitting on the left side will toss a penny for Ocean, while the person on the right will toss a penny for Lucy.
2. For each toss, each partner should:
   - Hold a penny in cupped hands.
   - Shake it to the count of ten.
   - Allow it to drop from a height of about 20–40 cm (8–16 inches) onto the desk.

Table 2: Critter Code

Characteristic	Alleles	Trait
Body segments (number)	**BB** **Bb** **bb**	3 3 2
Leg color	**LL** **Ll** **ll**	blue blue red
Eyes (number)	**EE** **Ee** **ee**	2 2 3
Nose length	**NN** **Nn** **nn**	long medium short
Tail color	**TT** **Tt** **tt**	blue blue orange
Tail style	**SS** **Ss** **ss**	curly *curly or straight straight
Antennas (number)	**AA** **Aa** **aa**	2 2 1
Spikes (color and number)	**GG** **HH** **GH**	1 short blue 2 long green 1 short blue + 2 long green

** To find out if an **Ss** critter's tail is curly or straight, toss a coin. If it shows heads, the critter's diet contains "crittric" acid, and it develops a curly tail. If the coin shows tails, the critter's diet does not contain "crittric" acid, and it develops a straight tail.*

3. The partner on the left tosses a penny to determine which allele for number of body segments Ocean gives to his offspring. If the penny shows heads, write *B* in the column titled "From Ocean" on Student Sheet 65.1. If the penny shows tails, write *b*. The other partner tosses a penny to determine the allele which Lucy gives. Write the letter for that allele in the column titled "From Lucy."
4. Determine the offspring's phenotype for number of body segments. Look at the alleles you wrote under "From Ocean" and "From Lucy." Compare these alleles with the Critter Code in Table 2 (or with the information in the first column of Student Sheet 65.1). Then write the appropriate trait in the next column. For example, if you wrote Bb for the alleles, the trait is "3 segments."
5. Continue tossing coins and filling in Student Sheet 65.1 until you have completed the table. Use the Critter Code to determine the phenotype for each characteristic, based on the genotype of the offspring. Note the special instructions for tail style.

6. Find out if your critter is male or female by determining its sex chromosomes as follows:

   a. Ocean is an XY male. The partner representing Ocean tosses a penny. If it shows heads, Ocean donates an X chromosome to the offspring. If the penny shows tails, Ocean donates a Y chromosome to the offspring.

   b. Lucy is an XX female. The partner representing Lucy does not need to toss a penny. Lucy can donate only an X chromosome to the offspring.

   Write the sex (male or female) of the offspring in the appropriate space.

7. Use the following materials provided by your teacher to make your critter.

Table 3: Critter Parts

Body segments	Large foam balls connected by toothpicks
Heads	Small foam balls
Legs	Pieces of red or blue drinking straws
Eyes	Blue thumbtacks
Nose	Brass fastener, adjust length
Tail	Blue or orange pipe cleaner
Antennas	Yellow paper clip
Spikes	Pieces of blue or green drinking straws

8. Draw your critter and color in the body parts.

ANALYSIS

1. Look at the other critters made by your classmates. They are all siblings (brothers and sisters). What are their similarities and differences?

2. Which characteristics show a simple dominant/recessive pattern like tail color? List them in a table and indicate which version is dominant and which is recessive for each trait.

   Hint: Look at Table 1 to see which traits have this pattern.

   Some traits do not show a simple dominant vs. recessive pattern. Look at Table 1 to help you answer Questions 3–5.

3. For which characteristic do some offspring have traits in between Skye's and Poppy's traits? Explain. (For example, in some plants, a cross between a red- and white-flowered plant will give pink-flowered offspring. This is called incomplete dominance.)

4. For which characteristic do some offspring have both Skye's and Poppy's traits? Explain. (For example, in humans, a person with type A blood and a person with type B blood can have a child with type AB blood. This is called co-dominance, as both traits appear in the offspring.)

5. Which critter trait is affected by an environmental factor, such as light, temperature, or diet? Explain.

6. Consider the pattern for sex determination.

   a. How is a critter's sex determined?

   b. Whose genetic contribution—Ocean's or Lucy's—determines the sex of the offspring?

7. Who does your critter most look like—Skye, Poppy, Ocean, or Lucy? On which traits did you base your choice?

8. Draw a critter with all recessive traits. Since there is not a recessive trait for spikes, do not include spikes in the drawing.